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(54) Electronic throttle control with adjustable default mechanism

(57) An electronic throttle control system is described having a housing (22) with a motor (40), throttle valve (60), gear mechanism (48,102,104), and fail-safe mechanism (104,132,134). A spring member (132) attached to a gear member (104) and default lever (134), and which is biased when the throttle valve (60) is in its fully open and closed positions, operates to open the throttle valve in the event of an electric failure, thus allowing the vehicle to limp home. An adjustable pin member (284) is used to adjust the position of the default lever (134) and thus the throttle valve in a fail-safe situation.

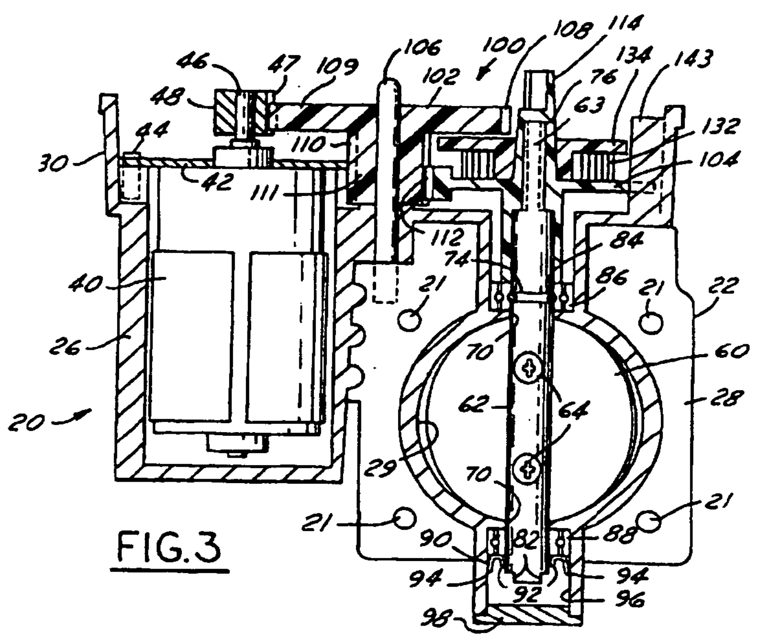

FIG.3

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Description

[0001] This invention relates to electronic valve control systems and more particularly to an electronic throttle control system for an internal combustion engine.

[0002] The present application is related to the following copending patent applications "Electronic Throttle Control With Default Mechanism Subassembly," based on US Serial No. 09/239,695; "Throttle Body Shaft Axial Play Control," based on US Serial No. 09/240,762; and "Default Mechanism For Electronic Throttle Control System," based on US Serial No. 09/240,761.

[0003] Valve assemblies for engines and related systems typically utilise rotatable valve members in fluid flow passageways to assist in regulating fluid flow through them. For example, throttle valve members are positioned in air induction passageways into internal combustion engines. The valve assemblies are controlled either mechanically or electronically and utilise a mechanism which directly operates the valve member.

[0004] Known electronic throttle control assemblies utilise a plurality of components which typically are difficult and time consuming to assemble together. Also, the throttle or valve plate is positioned on a throttle body shaft which often experiences undesirable axial or radial movement which can adversely affect the operation of the valve assembly.

[0005] For electronic throttle control systems, it also is desirable to have a fail-safe mechanism or system which allows the throttle valve to open or remain open in the event that the electronic control or electronic system of the vehicle fails.

[0006] It would be desirable to have an electronic valve control system which addressed the above concerns and provides an improved assembly and system, which also reduces cost and improves reliability.

[0007] The present invention provides an electronic throttle control assembly having a housing with a motor, a gear train and throttle valve. A throttle plate is positioned on a throttle shaft and the plate and shaft are positioned in the engine air induction passageway, such that the throttle plate regulates airflow into the engine.

[0008] The operation of the throttle valve is accomplished by a gear train assembly driven by a DC motor. The motor is regulated by the electronic control unit of the vehicle which in turn is responsive to the input of the vehicle operator or driver. A throttle position sensor is included in a housing cover and feeds back the position of the throttle plate to the electronic control unit.

[0009] The throttle body shaft is held in the throttle valve section of the control assembly housing by bearing members. Axial and radial movement ("play") of the throttle body shaft is prevented by an axial clip member which is secured on one end of the shaft.

[0010] In the operation of the throttle valve, a gear connected to the motor operates an intermediate gear, which in turn operates a sector gear which is connected to the throttle body shaft. The sector gear is biased by a spring member in both the open and closed positions of the throttle valve.

[0011] As a fail-safe mechanism, a default lever is operably attached to the spring member and operated by a boss attached to the intermediate gear. The bias of the spring member in combination with the default lever operates to open the throttle valve in the event of failure of the electronic system. In one embodiment of the invention, the default lever, spring member and a gear member are interlocked together as a subassembly to improve the assembly process for the entire electronic throttle control assembly. In another embodiment, the default position of the throttle valve is adjustable to insure operation in various conditions and engines.

[0012] The invention will now be described further, by way of example, with reference to the accompanying drawings, in which:

Figure 1 illustrates an electronic throttle control assembly in accordance with the present invention;
Figure 2 is an exploded view of the electronic throttle control assembly of Figure 1;
Figure 3 is a cross-sectional view of the electronic throttle control assembly of Figure 1, the cross-section being taken along line 3-3 in Figure 1 and in the direction of the arrows;
Figure 4 depicts an intermediate gear member which can be utilised with the present invention;
Figure 5 illustrates a default lever which can be utilised in the present invention;
Figure 6 illustrates a "clock-spring" embodiment of a spring member which can be utilised with the present invention;
Figure 7 illustrates a sector gear member which can be utilised with the present invention;
Figure 7A illustrates an alternate embodiment of sector gear member with a sensing means thereon;
Figure 8 illustrates a sub-assembly of a sector gear, spring member and default lever in accordance with one embodiment of the present invention;
Figures 9, 10 and 11 illustrate the range of operation of a gear train in accordance with one embodiment of the present invention;
Figures 9A, 10A and 11A illustrate the positioning of the throttle valve plate during the range of operation of the present invention;
Figures 9B, 10B and 11B illustrate the movement of use of a spring member during the range of operation of the present invention;
Figure 12 illustrates another embodiment of a spring member which can be used with the present invention;
Figure 13 illustrates an axial spring clip member which can be utilised with the present invention;
Figure 14 illustrates the positioning of a axial spring clip member on a throttle shaft in accordance with

one embodiment of the present invention;

Figure 15 is a schematic illustration showing a representative circuit diagram which can be utilised with the present invention;

Figure 16 illustrates an adjustable default mechanism which can be utilised with the present invention; and

Figures 17-19 illustrate an alternative embodiment of cover member and an alternative embodiment of the invention.

[0013] Figure 1-3 illustrate one embodiment of an electronic throttle control assembly in accordance with the present invention. Figure 1 illustrates the assembly 20 in its assembled form, Figure 2 illustrates the components of the assembly in an exploded condition, and Figure 3 is a cross-sectional view of the assembly 20 as shown in Figure 1 (without the cover).

[0014] The electronic throttle control assembly 20 includes a housing or body member 22 and a cover member 24. The housing 22 includes a motor section 26, a throttle valve section 28, and a gear train section 30. The cover member 24 includes the throttle position sensor (TPS) 32, together with related electronics, which reads or "senses" the position of the throttle valve and transmits it to the powertrain control module (PCM) of the vehicle. In order to connect the PCM to the TPS, an electrical connector 25 is positioned on the cover 24. The connector preferably has six contacts 27 (see Figure 3): two to the motor which regulates the position of the throttle valve; and four to the TPS and related electronics.

[0015] When the driver or operator of the vehicle presses the vehicle accelerator, the PCM sends a signal to the electronics in the electronic throttle control assembly 20 which operates the motor which in turn operates the gear train and adjusts the position of the throttle valve. The throttle valve is positioned in the main air passageway 29 from the air intake inside the engine compartment to the internal combustion engine. The throttle valve thus regulates the airflow to the internal combustion engine.

[0016] The precise position of the throttle valve in the airflow passageway is sensed by the TPS and relayed or fed back to the PCM in order to confirm or adjust the desired throttle valve setting.

[0017] The cover member can be attached to the body member 22 in any conventional manner, such as the snap tab mechanism shown in Figures 1-3. For this purpose, a series of openings 120 are provided in the cover member for mating with a series of tab members 122 on the outside of the gear section 30 of the housing 22. Also, an appropriate gasket or sealing member (not shown) is preferably positioned between the cover member and the housing in order to protect the gear train and TPS from dirt, moisture and other environmental conditions. When the electronic throttle control assembly 20 is utilised, it is positioned in the engine compartment of the vehicle and bolted or otherwise securely fastened to the vehicle. For this purpose, a plurality of holes 21 are provided in the housing.

[0018] An alternate and presently preferred mechanism for attaching the cover member 24 to the housing 22 is shown in Figures 17-19. In this embodiment, the cover member 24' has an electrical connector 25' an alternative type of sensing mechanism 200 (discussed below). The cover mechanism 24' is attached to the housing by a plurality of fasteners 202 positioned through openings 204 in tab members 206. This eliminates any possible movement between the cover and housing.

[0019] Bushing members 208 are positioned in the four outer or corner openings of the cover member, while bushing members 210 are positioned in the two central or side openings. The bushing members 208 preferably are made of a metal material and are the same as the thickness T of the cover member 24'. This allows the cover member to be securely attached to the housing and at the same time prevent over tightening and compression of the cover member. The bushing members 210 which also are preferably made of a metal material are provided of extra length and are positioned in wider openings 212 in the housing 22. The bushing members 210 act as positioning dowels or pins in order to accurately position the cover member relative to the housing and thus to precisely align the sensing mechanism 200 in the cover with the sector gear member and throttle body shaft.

[0020] The motor 40, as best shown in Figure 3, is a twelve-volt DC motor. The motor 40 is connected to a mounting plate 42 which is bolted or otherwise securely fastened to the body member 22 by a plurality of bolts, screws, or other fasteners 44. The plate 42 also has a pair of plug-in contacts 45 (see Figure 3) which electrically connect the electronics in the cover member 24 to the motor 40.

[0021] The motor 40 has a shaft 46 on which a spur gear 48 is positioned. The spur gear 48 is preferably made of a powder-metal material press-fit onto the motor shaft 46. The gear 48 has a plurality of teeth 47 which mesh with and rotate adjacent gears, as described below. The throttle plate 60 is secured to a throttle body shaft 62 which in turn is positioned in the throttle section 28 of the body member or housing 22. The throttle plate 60 is secured to the throttle body shaft 62 by a plurality of small fasteners or plate screws 64. The throttle shaft 62 is positioned in a bore or channel 70 in the throttle section 28 of the body member 22. The bore 70 is transverse to the axis of the air flow passageway 29.

[0022] Throttle shaft 62 has an O-ring channel or groove 74, a pair of concave recesses 76 at the upper end 63 for secure connection to one of the gears (as explained below), a pair of openings 78 for positioning of the plate screws therethrough, an axial or longitudinally extending slot 80 for positioning of the throttle plate

60 therein, and a pair of flats or recesses 82 at the lower end for use in assembling and positioning the throttle valve. The flats 82 are utilised to rotate the throttle shaft 62 during assembly of the throttle plate and also to orient and hold the shaft stationary when a gear member is moulded and installed on it.

[0023] An O-ring 84 is positioned in the channel 74 on the throttle shaft. The O-ring 84 provides a seal between the air in the air flow passageway and the gear train components and electronics in the cover.

[0024] Before the throttle body shaft 62 is positioned in the housing 22, a pair of bearings 86 and 88 are installed in place in the housing. The bearings allow the throttle body shaft to rotate freely in the housing. The bearings 86 and 88 are conventional ball-bearing members with pairs of races separated by small ball-bearings.

[0025] As shown in Figure 3, once the throttle body shaft 62 is positioned in the housing - and before the throttle plate 60 is secured to it - an axial spring clip member 90 is secured to the lower end of the shaft. The spring clip 90 is also shown in more detail in Figures 2, 13 and 14. The spring clip 90 has a central annular disc 91, a plurality of inner spring tab members 92 and a plurality of outer spring tab members 94. The spring clip member 90 is preferably made of a spring steel material. The tab members 92 securely hold the axial spring clip member 90 in place on the throttle body shaft 62; tab members 94 securely hold the throttle body shaft 62 securely in position in the throttle section 28 of the body or housing member 22. In this regard when the assembly 22 is assembled, as shown in Figure 3, the outer tab members 94 are securely wedged against the inside surface of cavity 96 on the lower end of the throttle section 28, while the inner tab members 92 are wedged against the surface of the throttle shaft 62.

[0026] The axial spring clip member 90 eliminates axial or longitudinal movement (i.e., "play") of the throttle body shaft 62 inside of the throttle section. The upper end of the throttle body shaft 62 is secured against axial movement by the lower end of the moulded sector gear (as shown in Figures 3 and as described in more detail below), while the axial spring clip 90 securely and tightly affixes the lower end of the throttle body shaft against axial movement.

[0027] During assembly, the clip member 90 is pushed or forced onto the shaft 62 until it contacts the inner race of bearing 88. Preferably, the clip member 90 is installed with a predetermined load. The load preloads both of the bearings 86 and 88 and eliminates axial movement of the shaft in the assembly 22. The pre-load on the bearings also eliminates any radial movement or "slop" between the inner and outer races of the bearings.

[0028] The elimination of the axial and radial movement of the throttle shaft in the assembly improves the quality of the feedback signal provided by the TPS to the PCM. The movement of the throttle body shaft, and hence the throttle plate, will be more accurately and precisely sensed and read by the TPS and thus more accurately and precisely relayed to the PCM. The preloading of the bearing members also eliminates the burnishing of the ball-bearing members in the bearings during normal vehicle operation.

[0029] For assembly of the throttle body shaft and throttle plate in the assembly 20, the throttle body shaft 62 is rotated in order to allow the plate 60 to be positioned in slot 80. The throttle body shaft 62 is then turned approximately 90 degrees in order to allow the throttle plate screws 64 to be secured through the shaft and plate, thereby securely affixing the plate to the shaft. Openings 63 are provided in the throttle plate for this purpose.

[0030] Thereafter, once the throttle valve plate is installed in position, and the electronic sensing mechanism is aligned and calibrated, an end cap member or plug member 98 is positioned on the end of the cavity 96. This protects the lower end of the shaft from moisture, dirt and other environmental conditions which might adversely affect the operation of the throttle valve.

[0031] The gear assembly or gear train used with the electronic control assembly 20 in accordance with the present invention is generally referred to by the numeral 100 in the drawings. The gear train mechanism 100 includes spur gear 48 attached to motor 40, an intermediate gear member 102 (Figure 4), and a sector gear member 104 (Figure 7). The intermediate gear 102 is mounted on a shaft member 106 which is secured to the housing or body member 22 (see Figures 1-3). The intermediate gear 102 can freely rotate on shaft 106.

[0032] The intermediate gear 102 has a first series of gear teeth 108 on a first section 109 and a second series of gear teeth 110 on a second section 111. A raised post or boss 130 which is used to actuate the default lever (as explained below), is positioned on the first section 109. A reinforcing ridge 131 is connected to the post. The gear teeth 108 on gear 102 are positioned to mesh with the gear teeth 47 on the motor driven gear 48, while the gear teeth 110 are positioned and adapted for mating with the gear teeth 112 on the sector gear 104. As shown in the drawings, the teeth 112 on gear 104 are only provided on a portion or sector of the outside circumference of the gear member.

[0033] The gear members 102 and 104 are preferably made of a plastic material, such as glass-filled nylon, although they can be made of any other comparable material, or metal, which has equivalent durability and function.

[0034] The sector gear 104 is preferably moulded onto the end 63 of the throttle body shaft 62. For this purpose, the concave recesses 76 are provided in the shaft 62 which allow the sector gear to be integrally moulded to the shaft and be permanently affixed thereto. The lower end 105 of the sector gear is preferably formed such that it contacts the inner race of bearing 86, as shown in Figure 3, thus helping to hold

throttle body shaft in axial position. In this manner, when the axial spring clip member 90 is installed in position, the shaft member is securely held by the lower end of the sector gear at one end and the spring clip member at the other end.

[0035] The sector gear 104 has a central portion or member 114 which extends above the gear train 100 and makes direct contact with the throttle position sensor (TPS) mechanism 32 in the cover member 24. In order for the TPS to read the position of the throttle valve plate 60, the TPS must be able to correctly sense or read the movement and rotation of the throttle body shaft 62. For this purpose, the central member 114 on the sector gear 104 is positioned in a mating hub or receptacle mechanism (not shown) in the cover member 24, which then by rotation or movement would be able to detect the movement and resultant position of the throttle valve plate 60.

[0036] In an alternative embodiment, as shown in Figure 7A, 17 and 18 a small magnet member 113 is positioned on the upper end of the central member 114' of sector gear 104'. The TPS is calibrated to read the direction of the magnetic field emanating from the magnet and thus read or sense the rotational movement of the throttle body shaft and valve plate in order to feedback the position to the PCM. For this purpose, a pair of semi-circular members 220 are provided on the cover 24'. The central member 114' is positioned within and rotates inside the members 220.

[0037] In order to operate the throttle valve plate 62, a signal from the PCM is sent to the motor 40 through the electronics module 32 or 200 in the covers 24 or 24'. The motor rotates spur gear 48 which then rotates intermediate gear 102. The rotation of gear 102 in turn rotates sector gears 104 or 104' and also throttle body shaft 62, which is directly attached to the sector gear. The rotation of shaft 62 accurately positions the valve plate 62 in the passageway 29 and allows the requisite and necessary air flow into the engine in response to movement of the accelerator.

[0038] A circular diagram 250 which schematically illustrates the actuation of the present invention is shown in Figure 15. A pedal member 252 with a return spring 254 is provided in the vehicle. One or more position sensors 256 read or sense the position of the pedal member 252 due to activation by the vehicle operator or driver. The sensed position is transmitted to the powertrain control module (PCM) 260. The motor control electronics and controllers are integrated into the PCM. The PCM also receives input and data from other sensors 262, such as the vehicle speed and mass airflow. The electronic throttle control assembly 20 has a PC motor 40 which, through a gear mechanism 100, operates the position of the throttle valve plate 60 in the air flow passageway 29. The sensor 32,200 reads or senses the position of the throttle valve plate and sends the appropriate data to the PCM. The PCM monitors all of the data and governs the control of the throttle valve motor 40 as needed.

[0039] The present invention also has a fail-safe mechanism which allows the throttle valve plate to remain open in the event of a failure of the electronics system in the throttle control mechanism or in the entire vehicle. For the "fail-safe" mechanism of the present electronic throttle control assembly 20, a spring member 132 and a default lever member 134 are utilised in combination with the sector gear member 104. For ease of assembly, the combination of sector gear member 104, spring member 132, and default lever member 134 are joined together to form a sub-assembly 140, as shown in Figure 8. This sub-assembly, in combination with ridge wall or stop member 143 in the gear train section 30 of the housing 22 act together to limit the operation of the valve plate member and control the operation of the fail-safe mechanism.

[0040] The default lever member 134, as best shown in Figures 2, 5 and 8, has a circular central collar member 136 on one side with a central opening 138 therein. The collar member 136 also has an opening or slot 142 which is adapted to mate with one end, particularly the inner end 144, of the spring member 132. The default lever member 134 also has a stop arm member 146, a driver arm member 148 and a pair of spring control arms 150 and 152. The control arms 150 and 152 rest on top of the spring member and act to hold it in place in the gear 104. The spring control arm 150 also has a snap-fit finger member 154 on the end thereof which is utilised to help hold the sub-assembly 140 together, as described below.

[0041] The central opening 138 of the default lever member 134 is positioned over the central member 114 of the sector gear 104. This allows the default lever 134 to rotate freely relative to the sector gear member. When the sub-assembly 140 is assembled, the spring member 132 is joined together with the default lever member 134. In this regard, the spring member 132 is positioned on the bottom of the default lever member 134 around the collar member 136, with the inner end 144 of the spring member 132 positioned in slot 142. The spring member 132 is then compressed sufficiently to allow the spring member to fit within the recessed area or cavity 160 on one side of the sector gear member 104 (see Figure 7). When the spring member 132 is positioned on the sector gear member 104, the outer end 162 of the spring member is positioned in the opening or slot 164 in the sector gear member between the sector of gear teeth 112 and the shoulder or tab member 166.

[0042] The bias of the spring member 132, together with the snap-fit finger member 154 hold the sub-assembly 140 together. The finger member 154 is forced over the ramp 155 and locked in place by tab 157. In this manner, the assembly of the three components of the gear train and fail-safe mechanisms into the electronic throttle control assembly is faster and easier. Rather than attempting to first assemble the sector gear

member in the gear section of the housing, and then mount the spring member 132 and default lever member 134 on the sector gear member, while at the same time biasing the spring member, instead the members 132, 134 and 104 are first assembled together to form sub-assembly 140 which is then positioned as a unit or sub-assembly in the gear train section 30 of the housing 22.

[0043] An alternative spring member 180 is shown in Figure 12. The spring member 180 is a helical torsion spring member and has a pair of ends 182 and 184. The torsion spring member 180 and be used in place of the helical "clock-type" spring member 132 described above. The ends 182 and 184 of the spring member 180 correspond generally to the inner and outer ends 144 and 162, respectively, of spring member 132 and generally provide a similar function and purpose. In this regard, however, end 182 of spring member 180 is positioned on top of the default lever member 134, rather than being positioned inside the collar member. The other end 184 of the spring member 180 is positioned in the same slot or opening 164 in the sector gear member 104 as the end 162 of the spring member 132.

[0044] The sector gear member 104 also has a first stop shoulder or first positioner member 170 and a second stop or second positioner member 172. The two stops or positioner members are utilised in combination with the stop arm member 146 and driver member 148 on the default lever member 134, and with the spring member 132 and wall ridge 143, to provide a fail-safe mechanism for use with the electronic throttle control assembly in accordance with the present invention.

[0045] During the operation of the fail-safe mechanism, the spring member 132 is positioned so that it is significantly biased in both directions of rotation, and has the least bias when the throttle plate is at a slightly opened position (i.e., the "default position").

[0046] As shown in Figures 9A and 10A, the throttle plate 60 has a range of operation between a fully closed position (Figure 9A) to a fully opened position (Figure 10A). In Figure 9A, the air passageway 29 is completely blocked off. In Figure 10A, the throttle plate is positioned parallel with the airflow thus allowing a full compliment of air to pass through the passageway 29. In this regard, when the throttle plate 60 is in its fully closed position, it actually is positioned about 7° from a position transverse to the air flow passageway axis. This allows better movement and ease of opening of the throttle valve member. Then, when the throttle valve plate member is in the default position, it is opened about 5°-10° from the throttle valve's closed position, or about 12°-17° from a position transverse to the axis of the air flow passageway.

[0047] The two stops or positioner members 170 and 172 on the sector gear 104 are used in combination with the wall ridge 143 on the housing 22, to limit the range of motion of the throttle valve and ensure that it does not go past the fully open or fully closed positions. For example, when the throttle valve plate is in its fully open position (Figure 10A), the second positioner member 172 is abutted against the wall stop 143 and prevented from opening any further (see Figure 10). When the throttle valve plate is in its fully closed position (Figure 9A), the first positioner member 170 is positioned adjacent the opposite side of wall stop 143. Separate stop screw 175 is actually used to stop further rotation of positioner member 170 and sector gear 104, thus preventing the valve plate from attempting to close more tightly and perhaps wedging shut or adversely affecting further operation (see Figure 9).

[0048] In the fail-safe position of operation, the throttle plate 60 is at a slightly open position, as shown in Figure 11A. In such a position, the throttle valve allows some air to flow through the passageway 29, thus providing the engine with sufficient inlet air to allow the vehicle to "limp-home".

[0049] When the sub-assembly 140 is positioned in the gear section 30, the spring member 132 is positioned such that its inner end 144 is significantly biased when the throttle plate is in its closed position, as shown in Figures 9A and 9B, while its outer end 162 is significantly biased when the throttle plate is in its fully open position, as shown in Figures 10A and 10B. Thus, at all times except when the throttle valve is in the default open position, the spring member 132 is significantly biased in one direction or the other during operation of the throttle control valve system. The force of the motor 40 acting through the gear train mechanism 100 overcomes the biasing forces provided by the spring member 132 and operates the control of the throttle valve plate 60.

[0050] The movements of the sector gear 104, default lever 134 and spring member 132 when the throttle valve 60 moves between the open, closed and default positions, are shown in Figures 9 and 9B (closed position), Figures 10 and 10B (open position) and Figures 11 and 11B (default position). The wall ridge 143 acts as a stop to limit movement of the default lever 134 (through stop arm member 148) and the sector gear member 104 (through first and second positioner members 170 and 172 as well as stop screw 175).

[0051] If the electronic system of the vehicle were to experience problems or fail, or if the electronics 32 or motor 40 were to fail, then the bias in the spring member 132 would return the default lever member 134 to the position shown in Figure 11, where the stop arm 148 would be positioned against the housing wall ridge member or stop 143. This would keep the throttle plate 60 at its partially opened position as shown in Figure 11A.

[0052] The operation of the fail-safe mechanism can be described simply in the following manner. The electronic throttle control assembly in accordance with the present invention utilises a single spring member for both the wide-open return and the default position mechanisms. The motor gear 48 drives the intermediate

gear 102 at its large diameter portion 109. The smaller diameter portion 111 of the intermediate gear then drives the sector gear 104, which in turn moves the throttle plate 60.

[0053] When the DC motor 40 is empowered, spring force maintains the throttle at the default position, approximately 5° above the closed-in-bore. One end of the spring member is grounded to the housing and the other end is grounded to the intermediate gear through the default lever.

[0054] As the throttle opens, the default lever grounds one end of the spring member to the housing while the other end of the spring member is advanced with the throttle plate. As the throttle plate closes past the default position, the default lever (which is advanced by the intermediate gear) moves one end of the spring member (the inner end 144 with spring meter 132) at a faster rate than the other end (the outer end 162 with spring member 132). At any position of the throttle, if power is interrupted to the motor, spring force will return the throttle to the default position, allowing for limited vehicle operation.

[0055] An alternative embodiment of the invention is shown in Figure 16. With this embodiment, the default position of the throttle plate is adjustable within a limited range. This allows adjustment of the default position depending on the particular vehicle and engine utilised.

[0056] In Figure 16, the gear section 30' of the assembly housing 22' is illustrated, together with the gear mechanism 100', including the spur gear 48 attached to the motor shaft 46 and the intermediate gear 102 positioned on shaft 106. The sector gear is also part of this embodiment, but not shown for reasons of clarity. The spring meter 132 is positioned around the collar member 136' of default lever member 134'. The default lever has stop arm 148' and spring control arms 150' and 152'.

[0057] In contrast to a single stop or wall member 143 described above, the embodiment shown in Figure 16 has a pair of spaced apart stop members 280 and 282. In addition, stop member 282 is provided with a threaded pin or screw meter 284 which is adjustable. By turning the head 286 of the screw member 284, the position of the opposite end 288 can be adjusted between stop meters 280 and 282. The end 288 acts as a stop member for default lever 134' and stop arm member 148'. The position of the stop end 288 adjusts or changes the default position of the throttle valve and thus the position of the throttle valve plate 60 in the air passageway 29.

Claims

1. A valve assembly comprising:

   a housing (22);
   a fluid passageway (72) in said housing (22);
   a shaft member (62) rotatably positioned in said housing (22) and extending through said fluid passageway;
   a valve member (60) positioned in said fluid passageway, said valve member (60) attached to said shaft member (62) and rotatable therewith;
   a gear mechanism (48,10,104) for rotating said shaft member (62) between a first position in which said valve member allows full passage of fluid through said fluid passageway and a second position in which said valve member prevents fluid from passing through said fluid passageway;
   driver means (40) for operating said gear mechanisms and rotating said shaft member; and
   default means (132,134) for rotating said shaft member (62) to a third position in which said valve member (60) allows a limited amount of fluid to pass through said fluid passageway; and
   adjustment means (284) for adjusting the position of the valve member upon default.

2. A valve assembly as claimed in claim 1, wherein said gear mechanism comprises a first gear member attached to said driver means and a second gear member operably attached to said shaft member; and

   said default means comprises a spring member positioned on said second gear member and a default lever member positioned on said second gear member;
   said second gear member, default lever member and spring member being connected together as a sub-assembly in said housing.

3. A valve assembly as claimed in claim 2, wherein said spring member has a first end connected to said default lever member and a second end connected to said second gear member.

4. A valve assembly as claimed in claim 3 wherein said spring member is a helical torsion spring member or a clock-type spring member.

5. A valve assembly as claimed in claim 2, wherein said gear mechanism further comprises a third gear member operably positioned between said first gear member and said second gear member.

6. A valve assembly as claimed in claim 2, wherein said default lever member has at least one spring support arm thereon.

7. A valve assembly as claimed in claim 2, wherein said default lever member has a finger member

thereon with a snap-fit connector means thereon for a snap-fit connection with said second gear member.

8. A valve assembly as claimed in claim 1, wherein said driver means comprises a motor positioned in said housing.

9. A valve assembly as claimed in claim 1, wherein said default means comprises a spring member positioned on said gear mechanism and a default member positioned on said gear mechanism in operable association with said spring member.

10. A valve assembly as claimed in claim 1, wherein said adjustment means comprises an adjustable pin member positioned on said housing and located to contact said default member and prevent further rotation thereof.

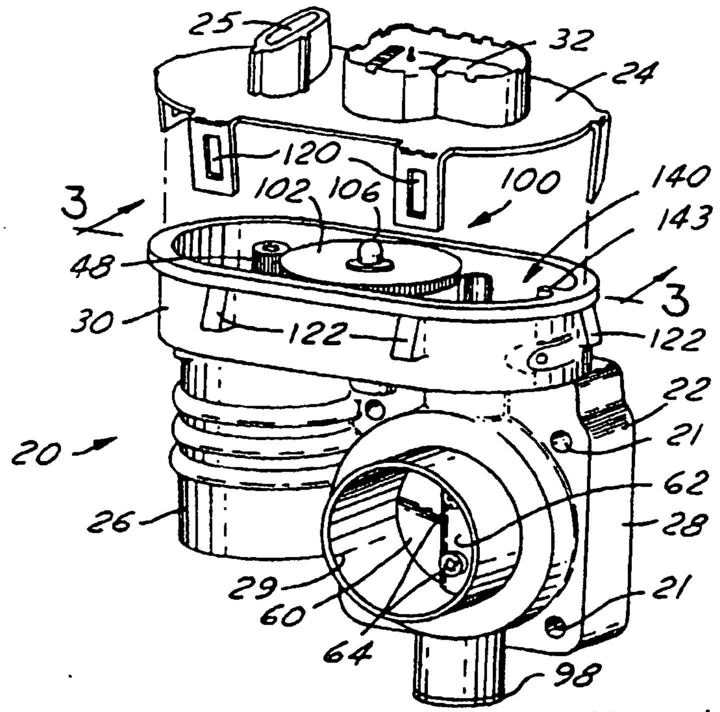
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FIG.1

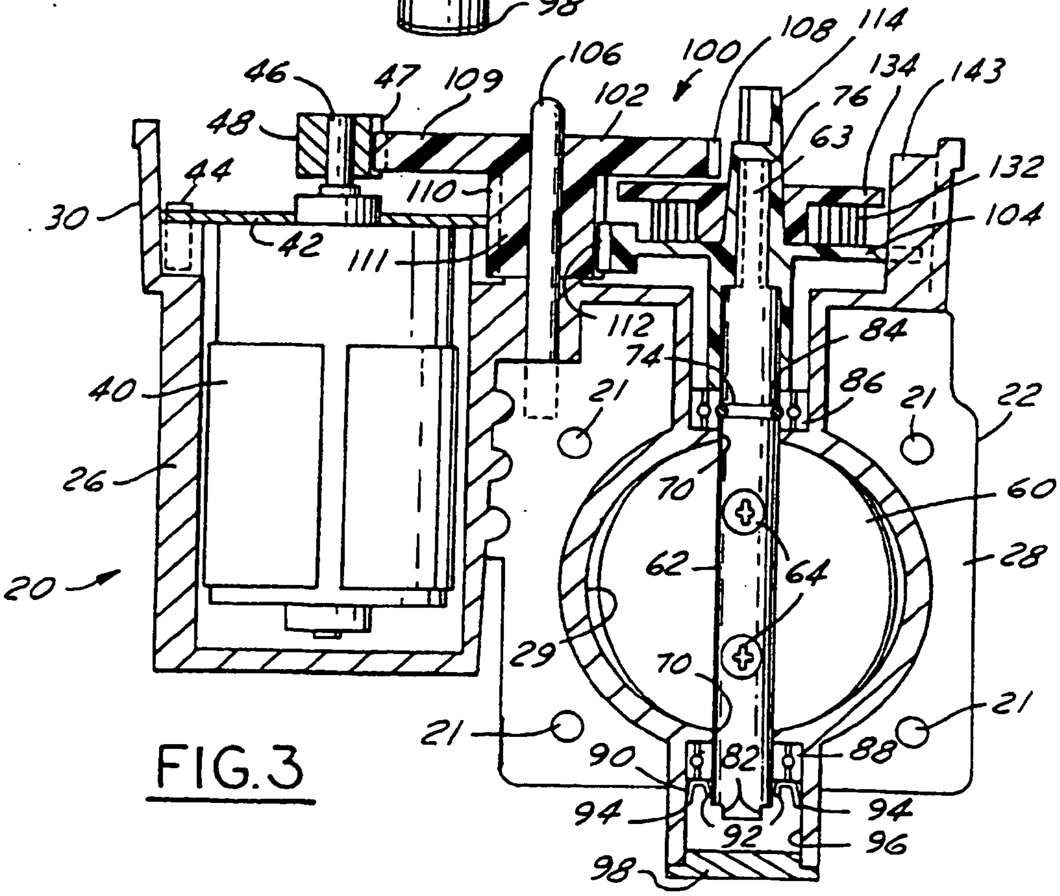
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FIG.3

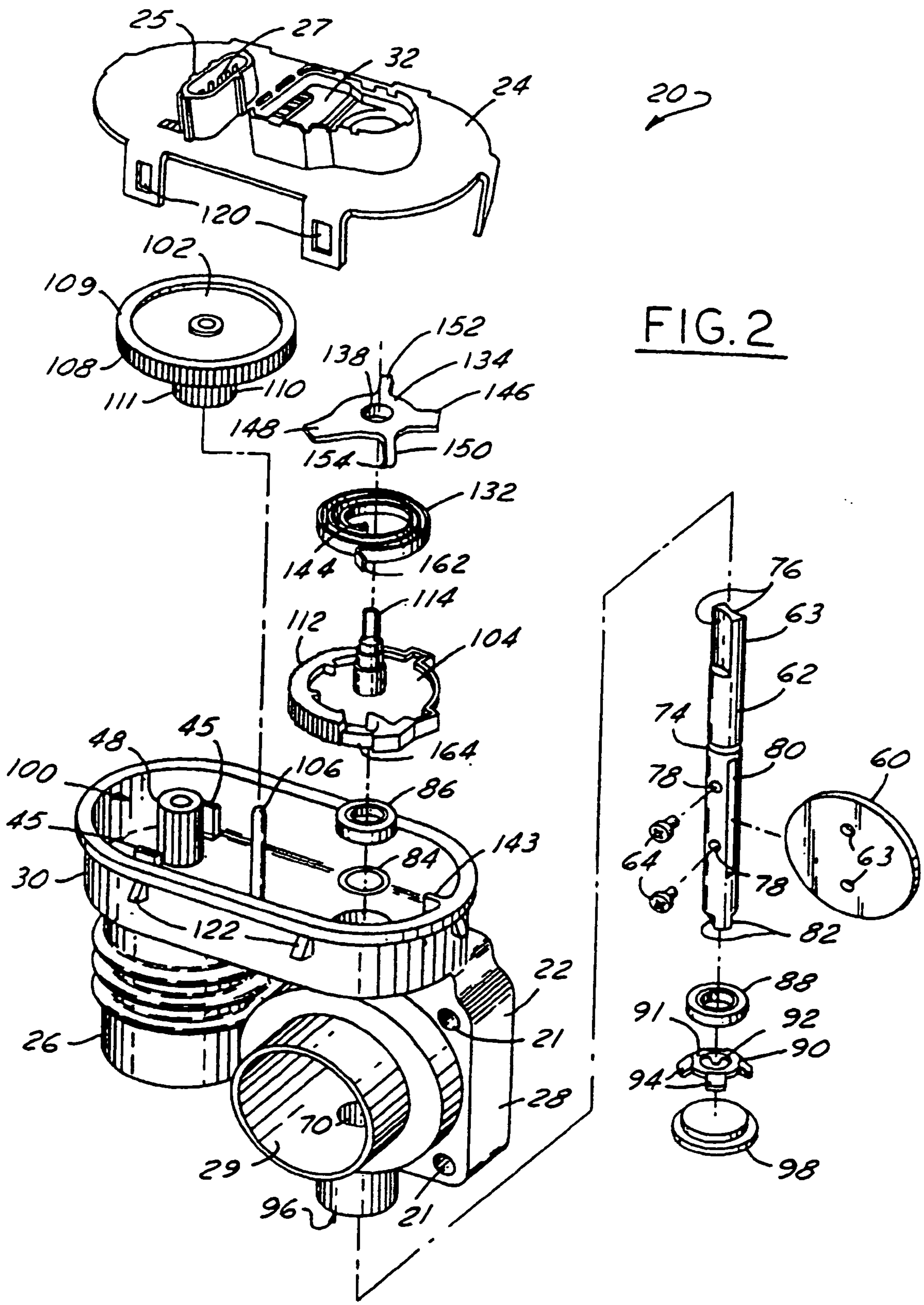
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FIG. 2

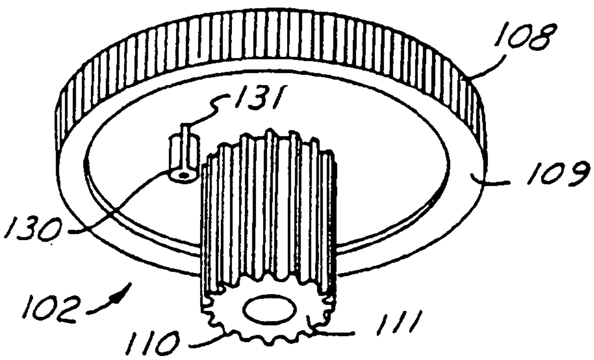

FIG. 4

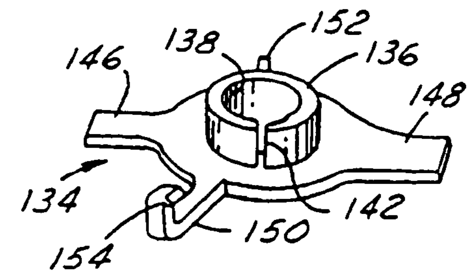

FIG. 5

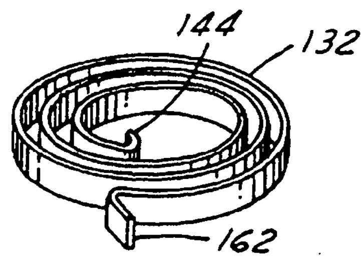

FIG. 6

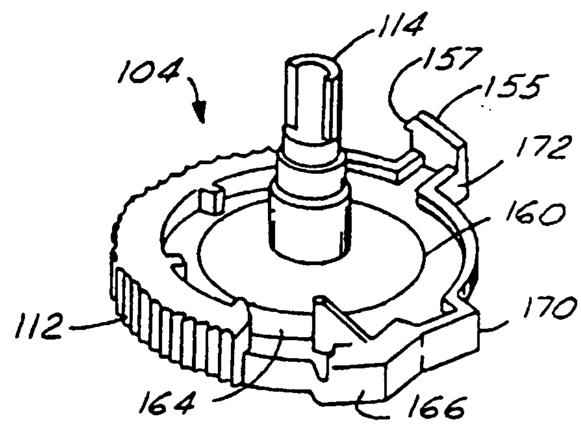

FIG. 7

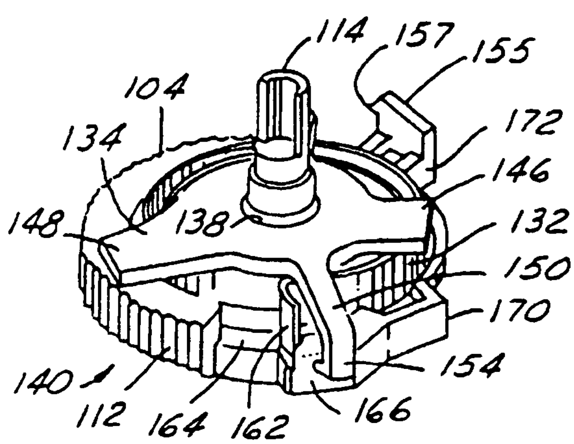

FIG. 8

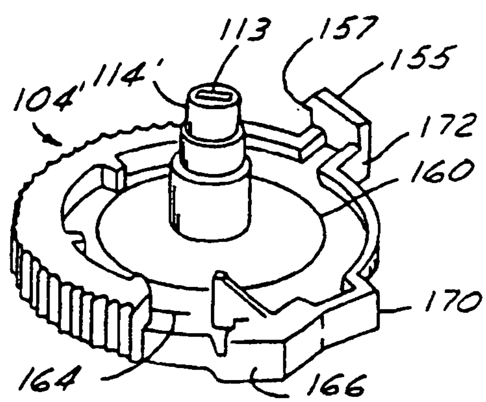

FIG. 7A

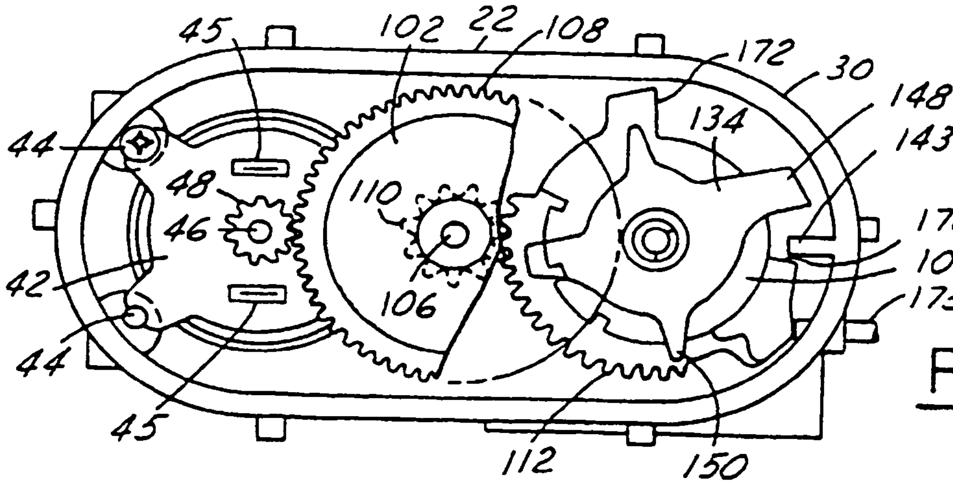

FIG.9

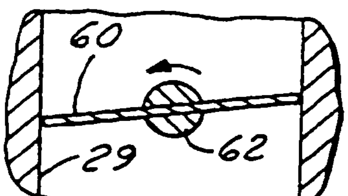

FIG.9A

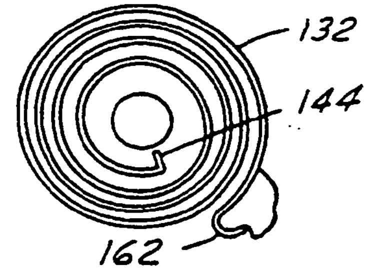

FIG.9B

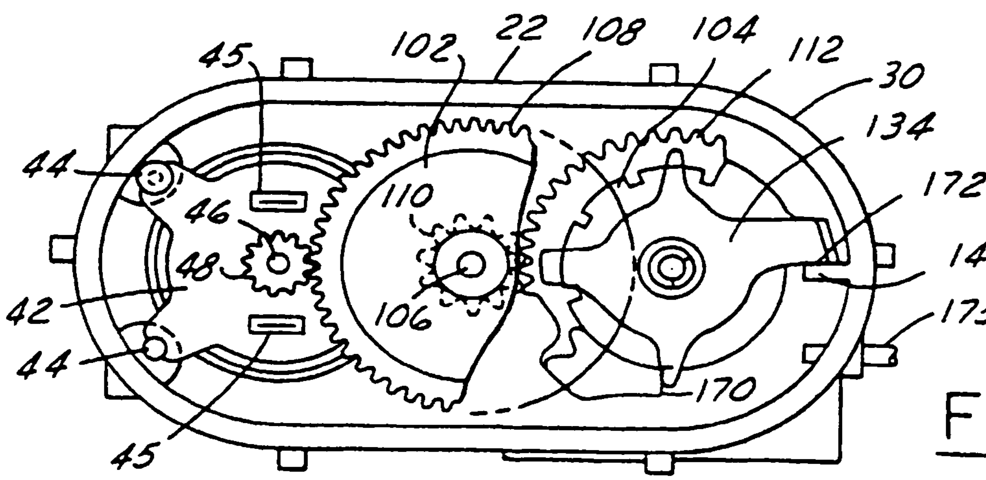

FIG.10

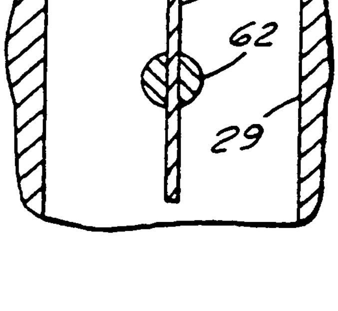

FIG.10A

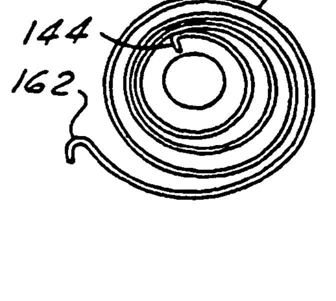

FIG.10B

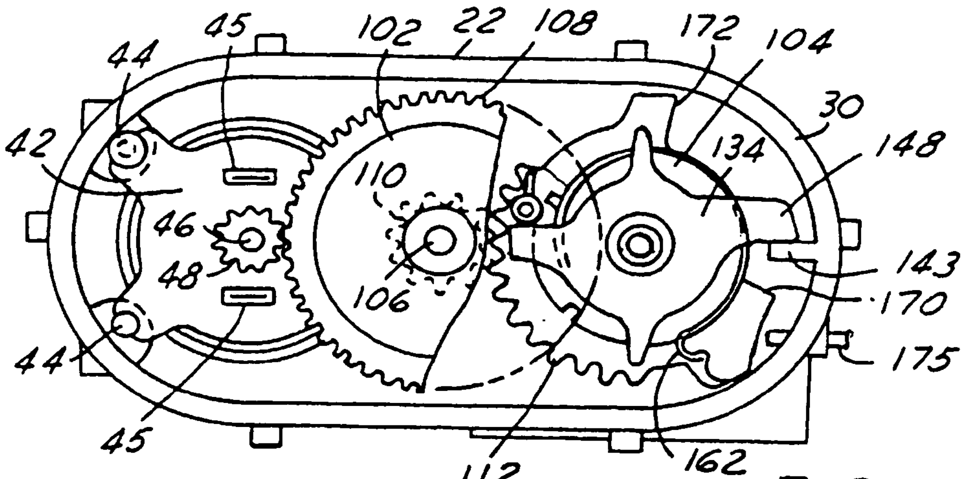

FIG.11

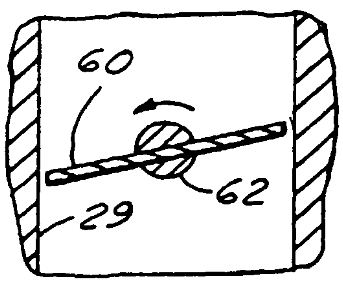

FIG.11A

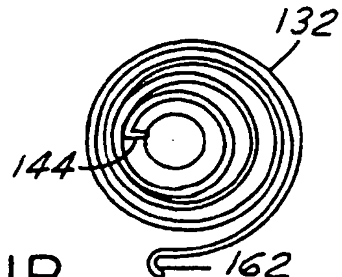

FIG.11B

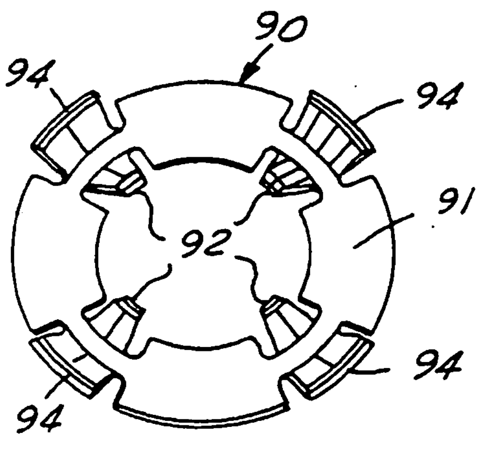

FIG.13

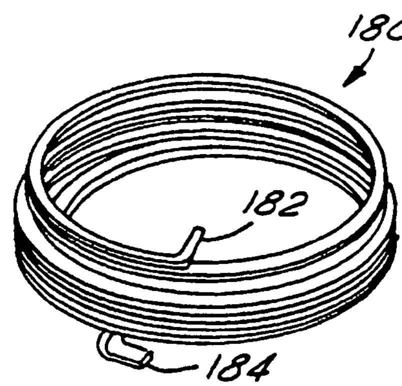

FIG.12

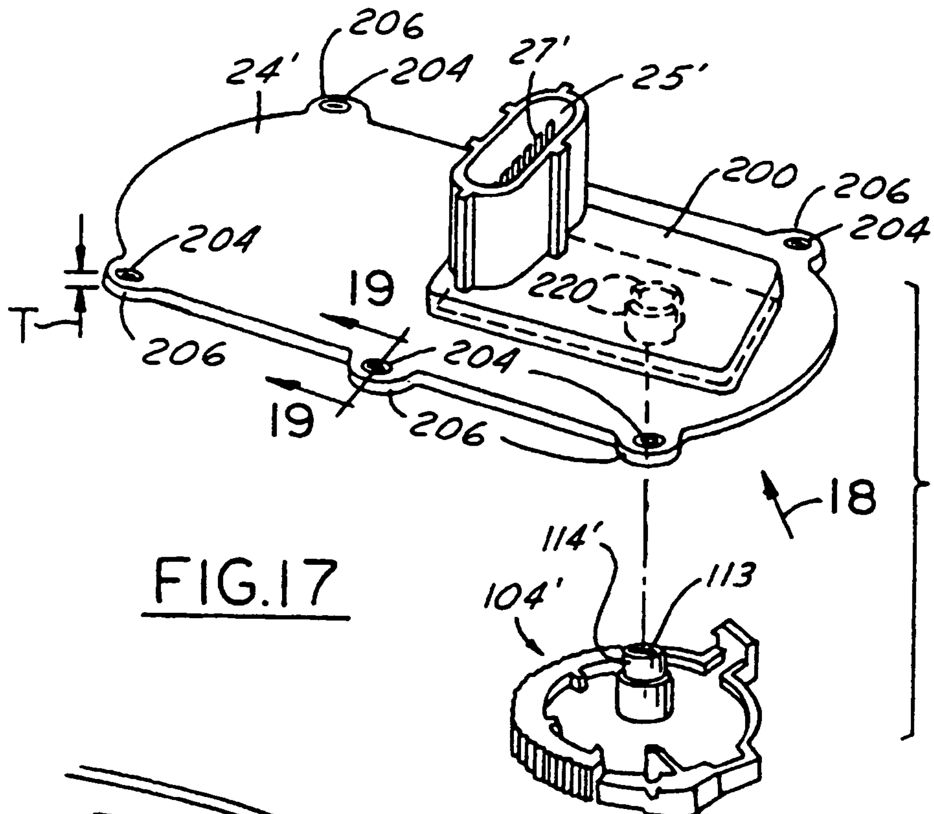

FIG.17

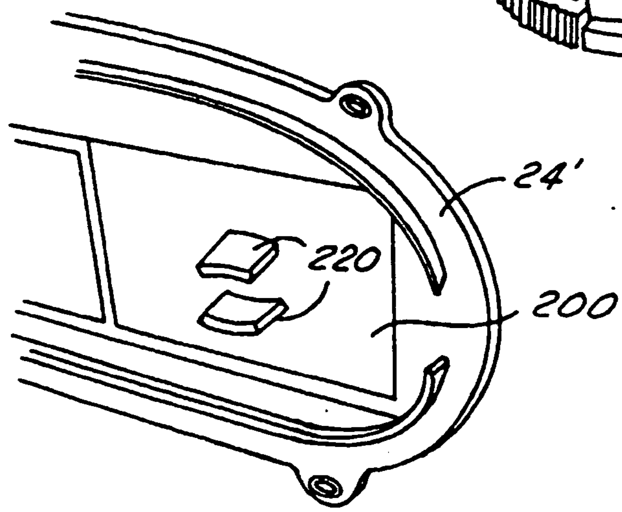

FIG.18

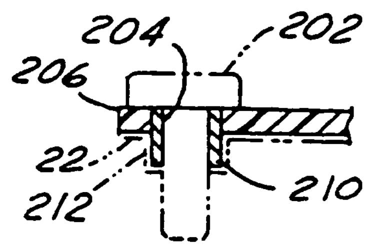

FIG.19

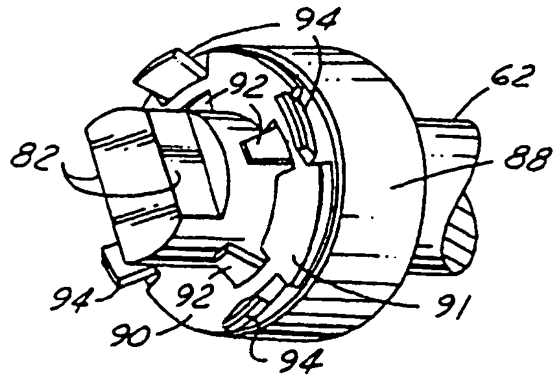

FIG.14

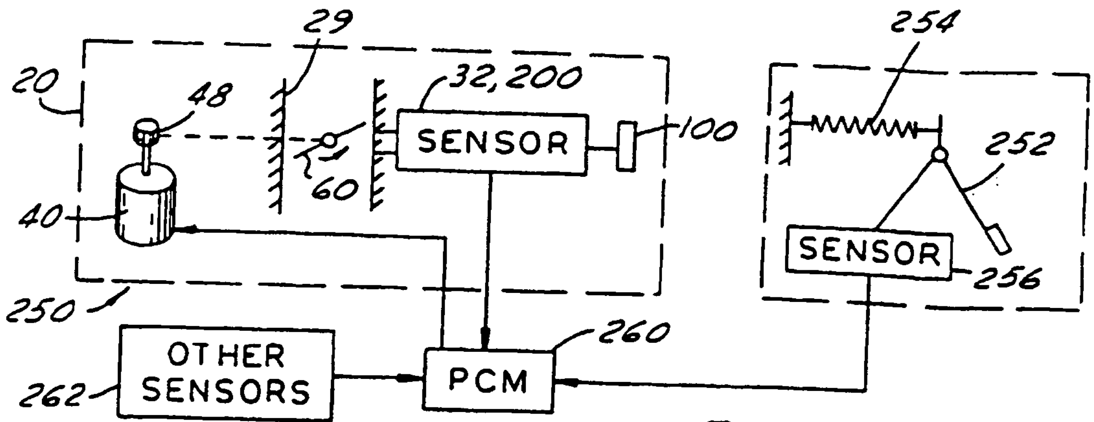

FIG.15

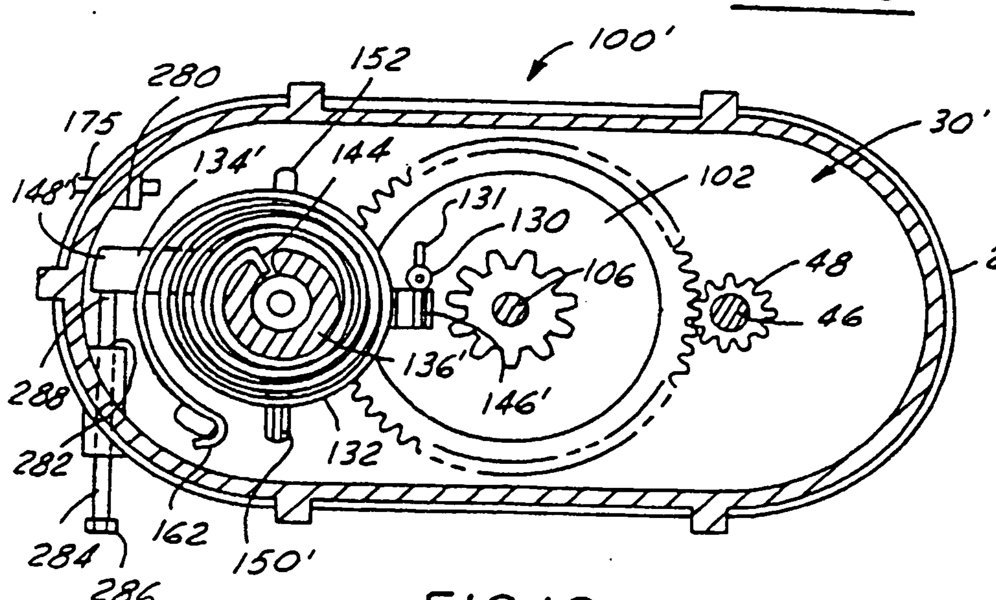

FIG.16

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European Patent Office
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(11) EP 1 024 268 A3

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(22) Date of filing: **10.01.2000**

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(30) Priority: **29.01.1999 US 240340**

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Dearborn, MI 48126 (US)

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(54) **Electronic throttle control with adjustable default mechanism**

(57) An electronic throttle control system is described having a housing (22) with a motor (40), throttle valve (60), gear mechanism (48,102,104), and fail-safe mechanism (104,132,134). A spring member (132) attached to a gear member (104) and default lever (134), and which is biased when the throttle valve (60) is in its fully open and closed positions, operates to open the throttle valve in the event of an electric failure, thus allowing the vehicle to limp home. An adjustable pin member (284) is used to adjust the position of the default lever (134) and thus the throttle valve in a fail-safe situation.

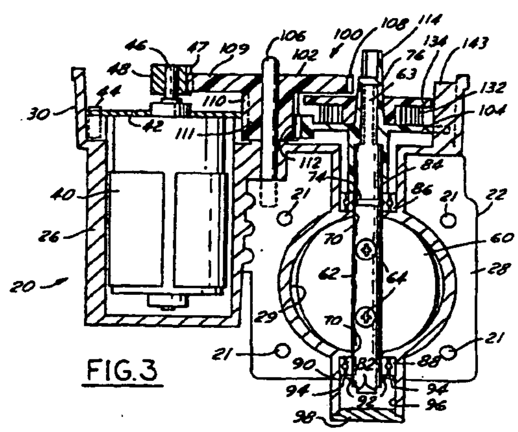

FIG.3

EP 1 024 268 A3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 30 0114

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X A	EP 0 828 067 A (HITACHI) 11 March 1998 (1998-03-11) * column 6, line 40 - column 11, line 13; figures 1-8 * * abstract *	1-5,7,8 9,10	F02D11/10
X Y A	DE 196 12 869 A (ROBERT BOSCH) 2 October 1997 (1997-10-02) * abstract * * column 2, line 54 - column 13, line 23; figures 1-8 *	1,8-10 9,10 2-6	
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A	DE 195 24 941 A (VDO ADOLF SCHINDLING) 9 January 1997 (1997-01-09) * abstract * * column 3, line 8 - column 4, line 8; figures 1-4 *	1-6,8,9	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	3 November 2000	Van Zoest, A

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